

**Appl. No.** : 09/980,682  
**Filed** : August 15, 2002

### **AMENDMENTS TO THE DRAWINGS**

The enclosed replacement sheets are being submitted in order to remove the captions of the original drawings which were objected to in the Office Action. Applicant respectfully requests that the previously submitted Sheets 1-39 be replaced by those which are enclosed herewith. No new matter is being entered herewith.



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

Inventors: AYRE et al.

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Atty Docket: HODG1.002APC

REPLACEMENT SHEET

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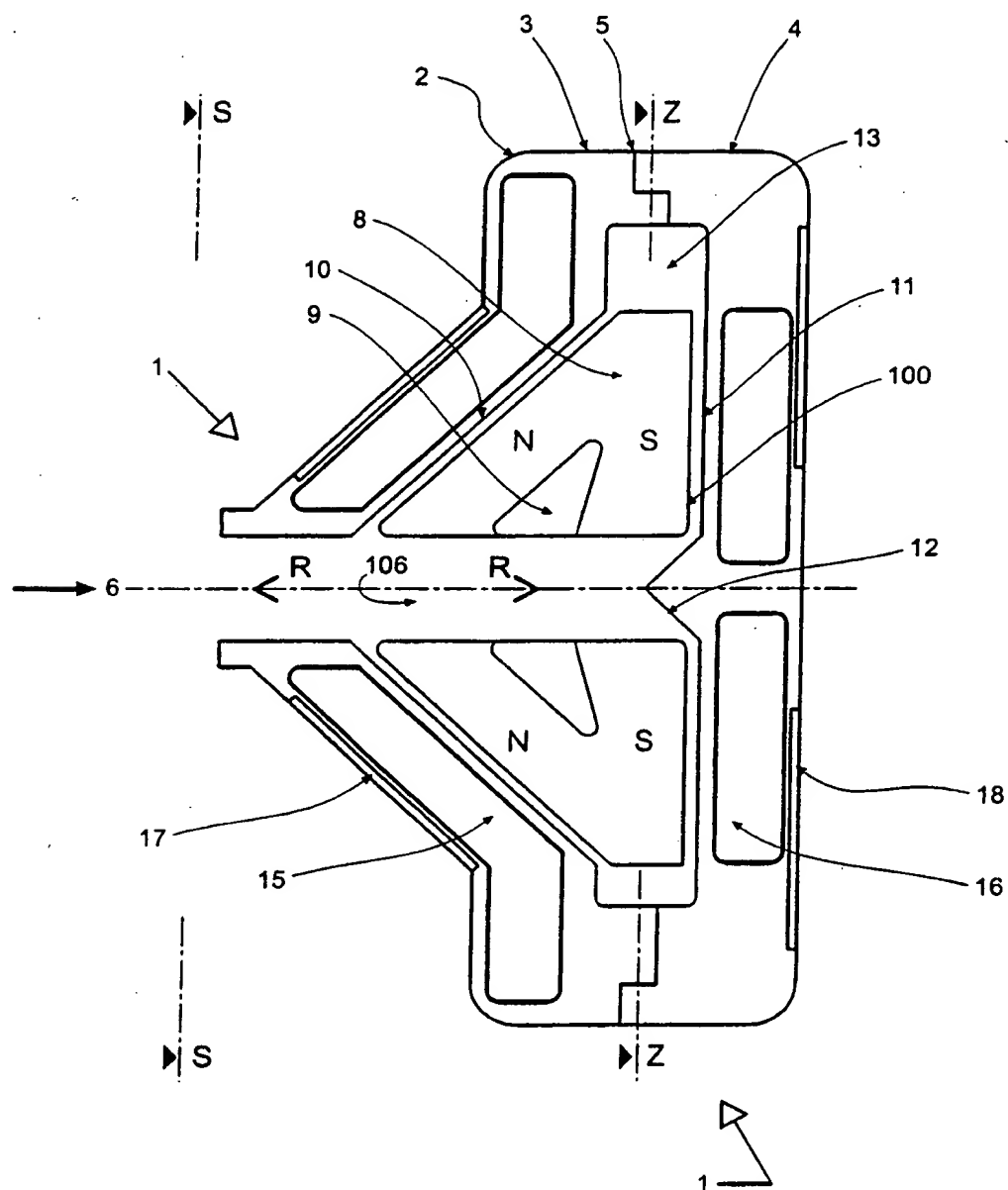


Fig. 1



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

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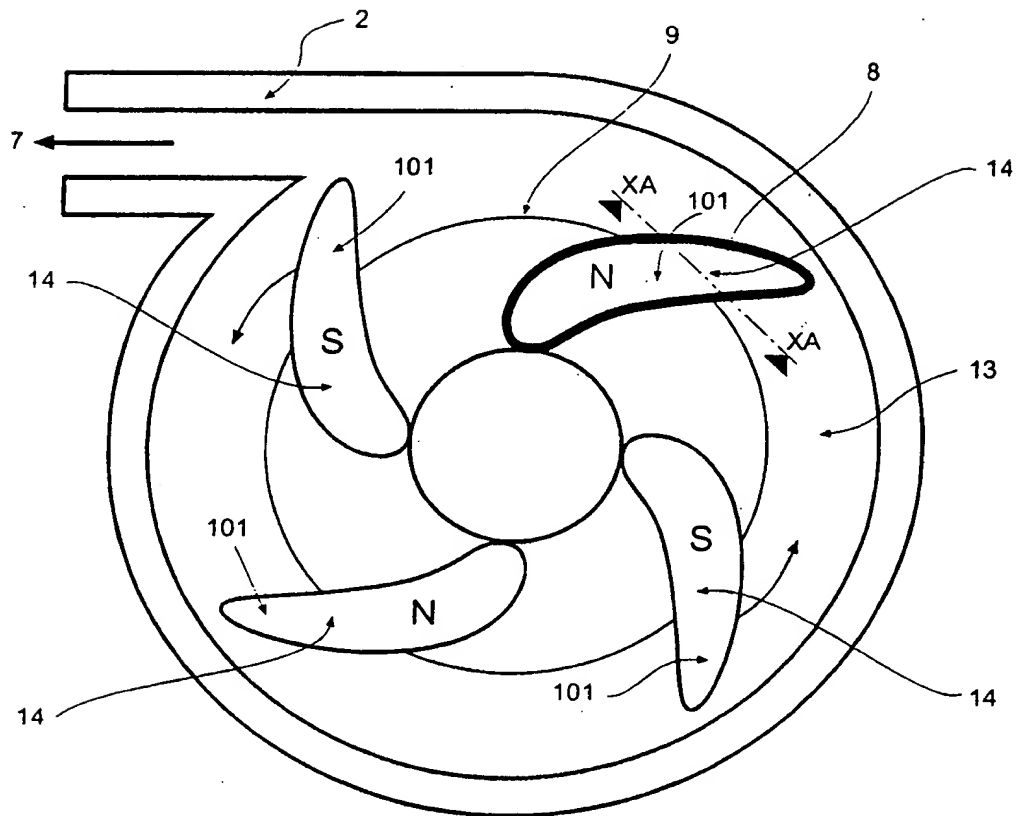


Fig. 2



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

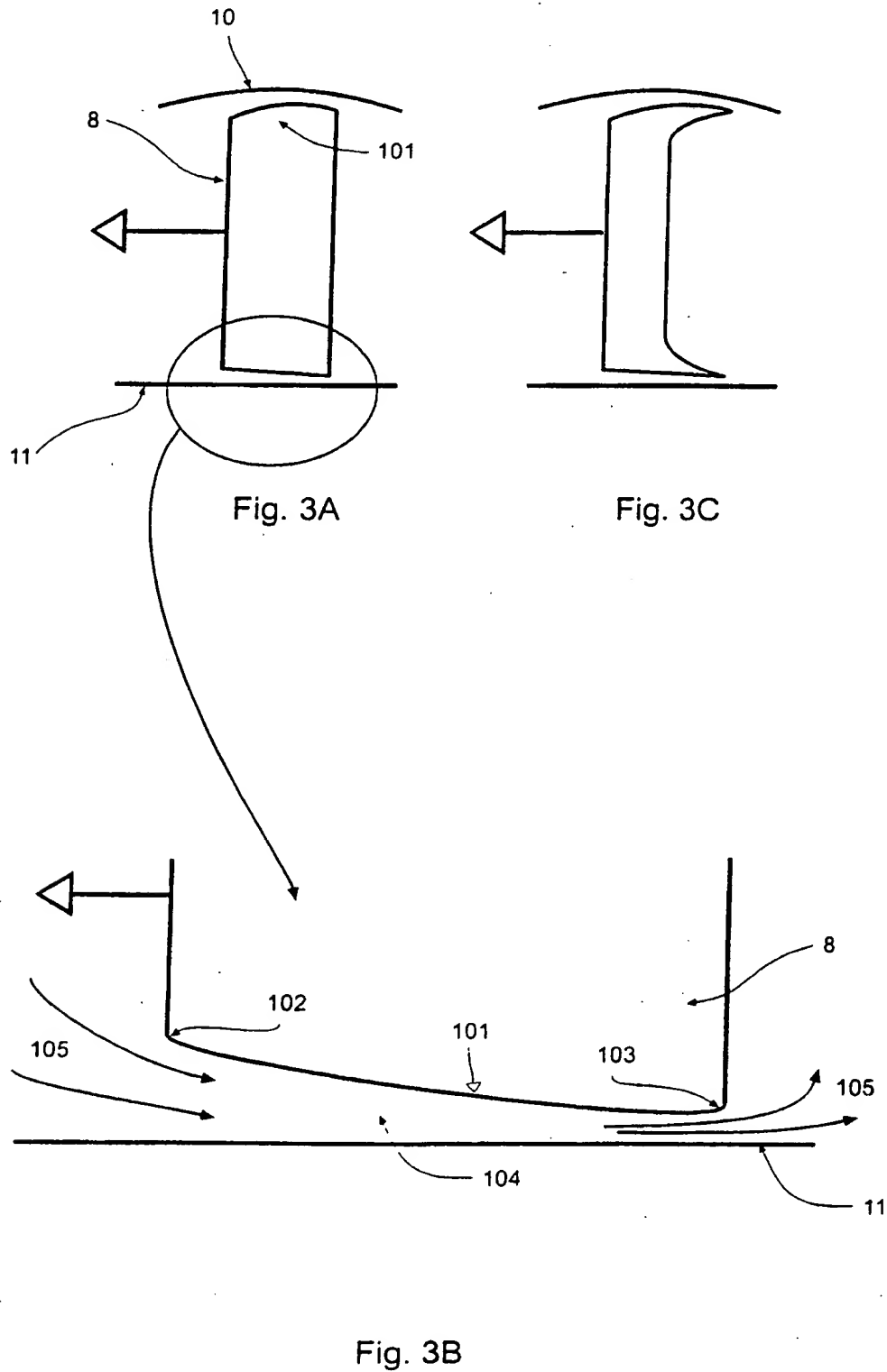
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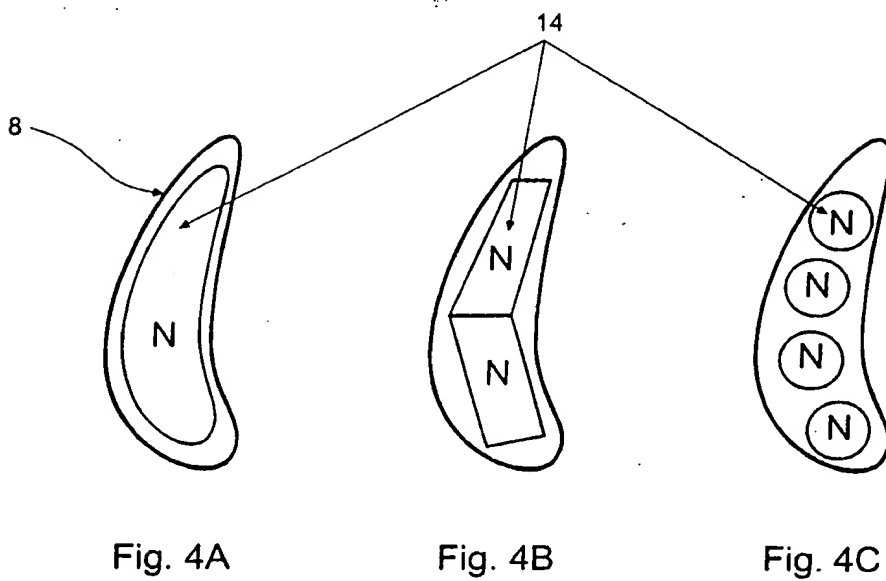
Inventors: AYRE et al.

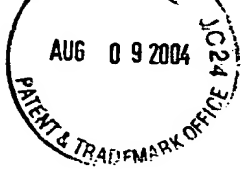
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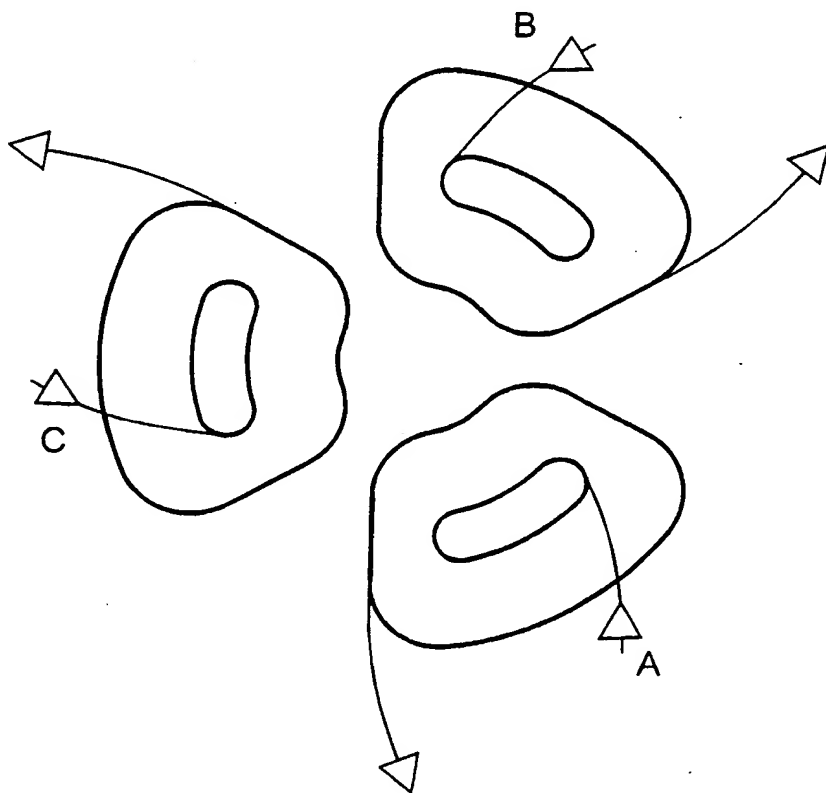
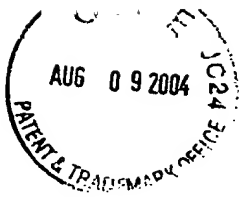


Fig. 5A



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

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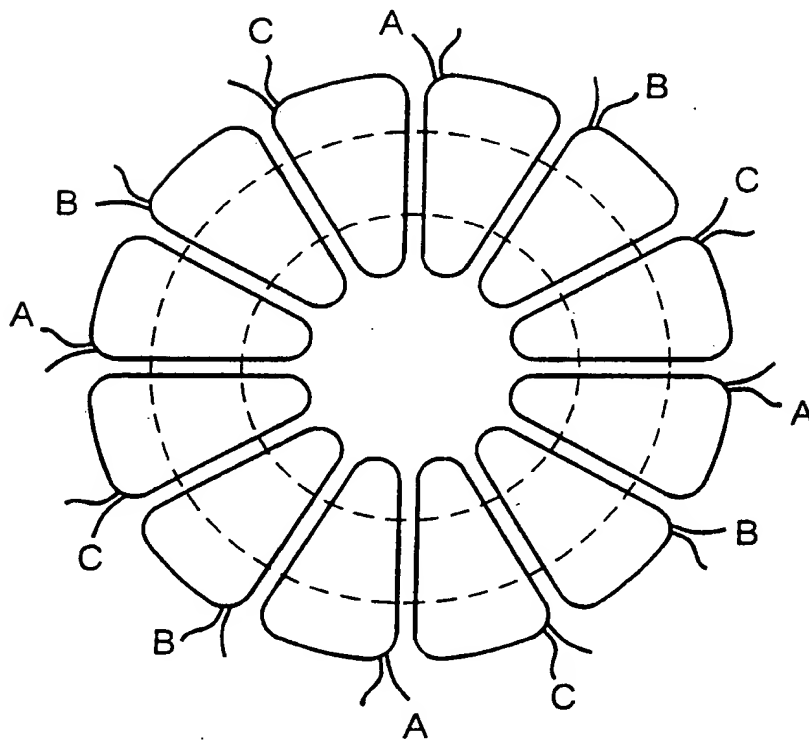


Fig. 5B

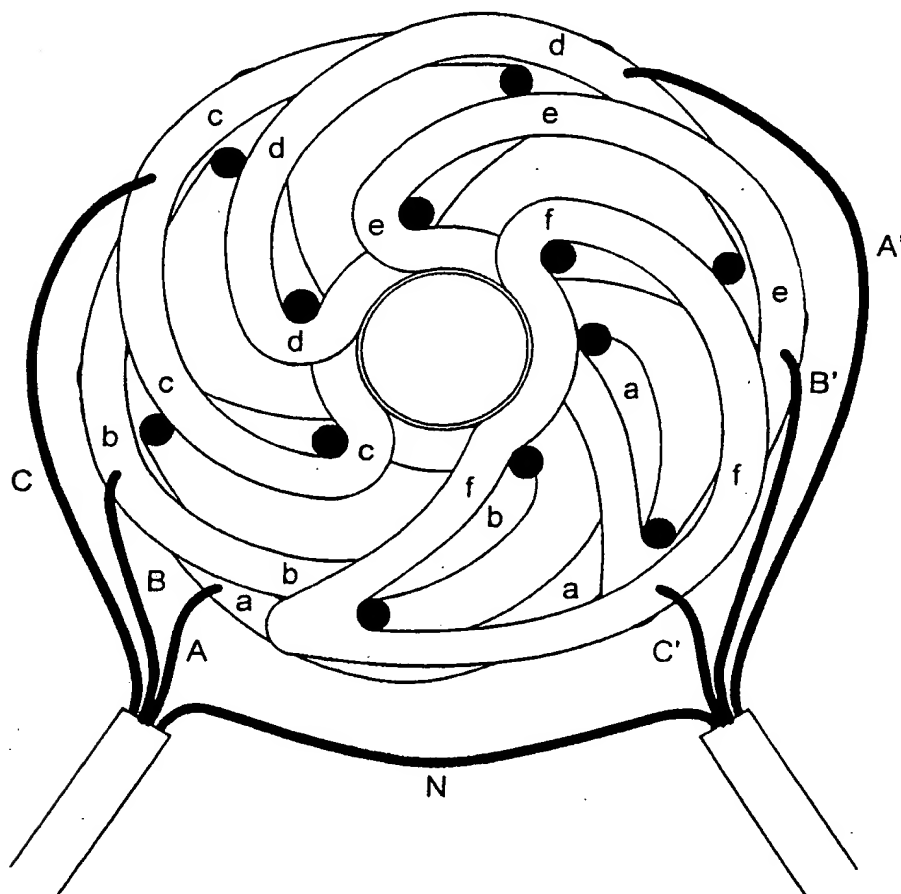


Fig. 5C





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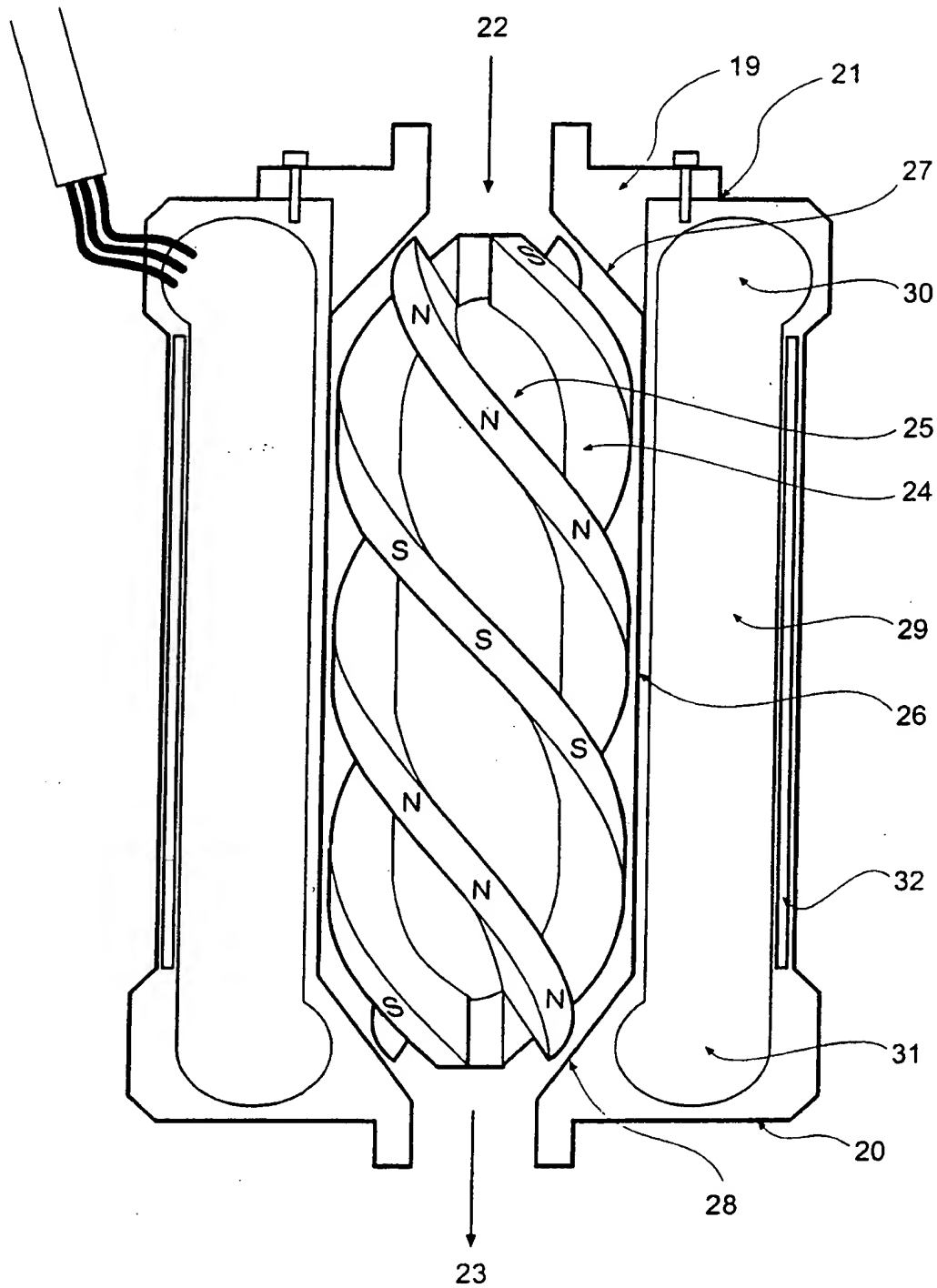


Fig. 6

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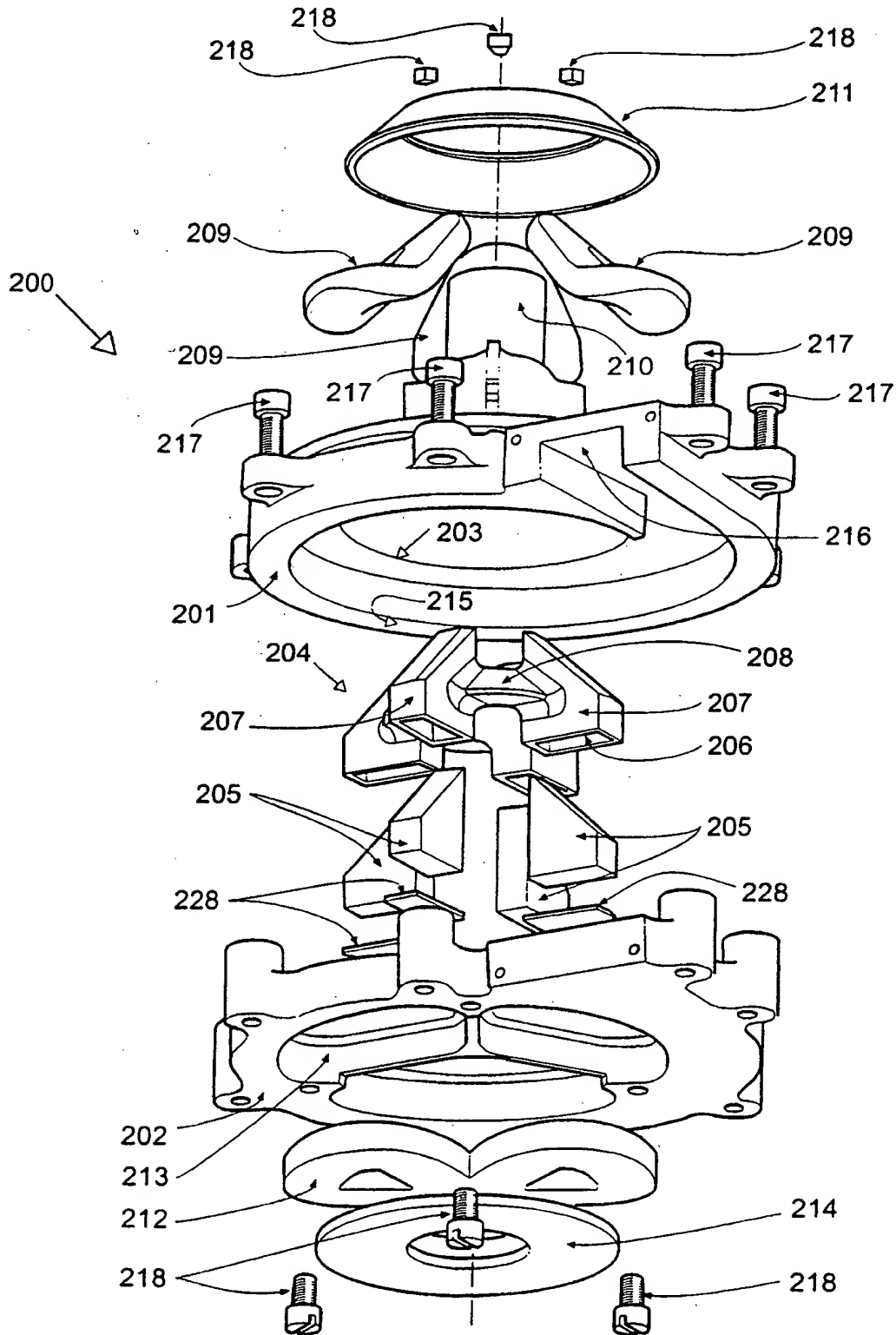


Fig. 7

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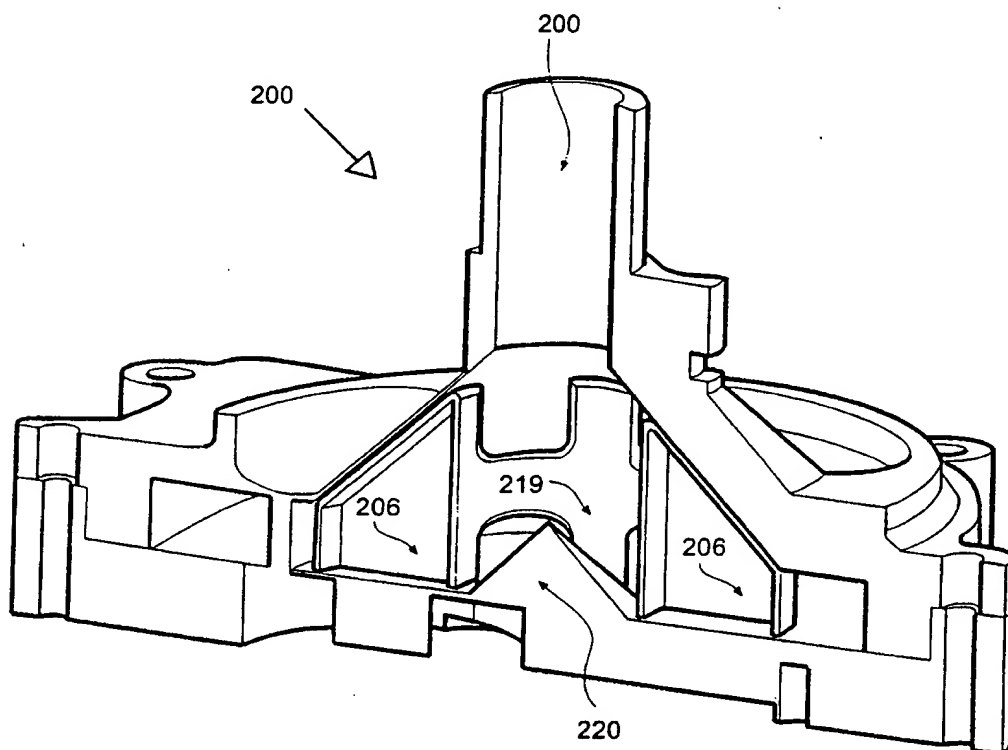


Fig. 9



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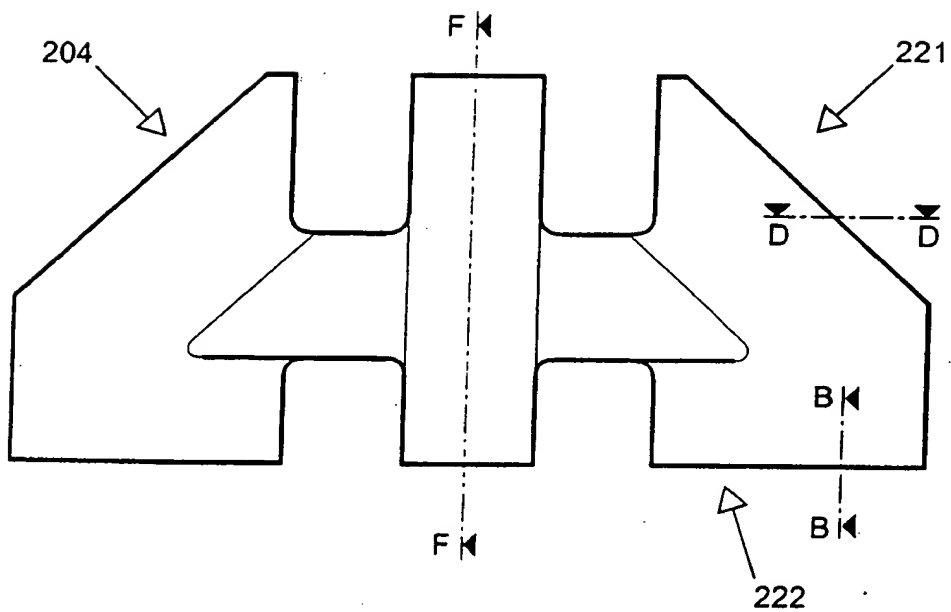


Fig. 10

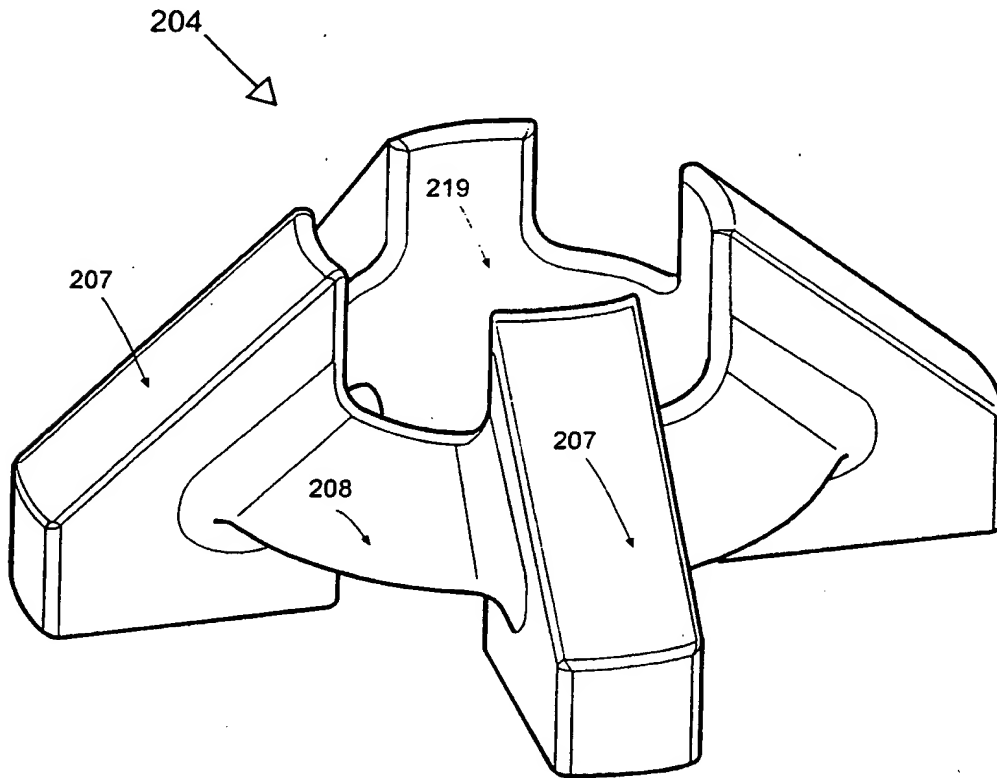


Fig. 8





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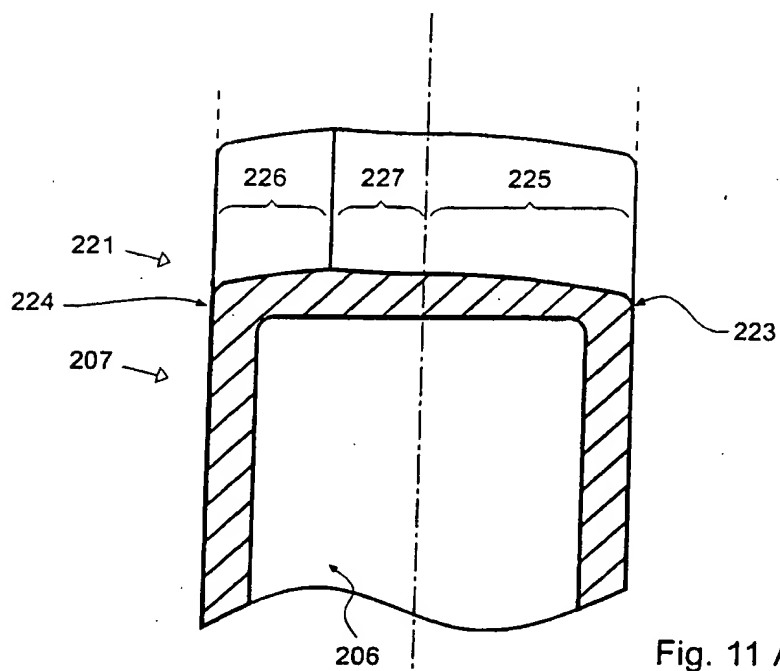


Fig. 11 A

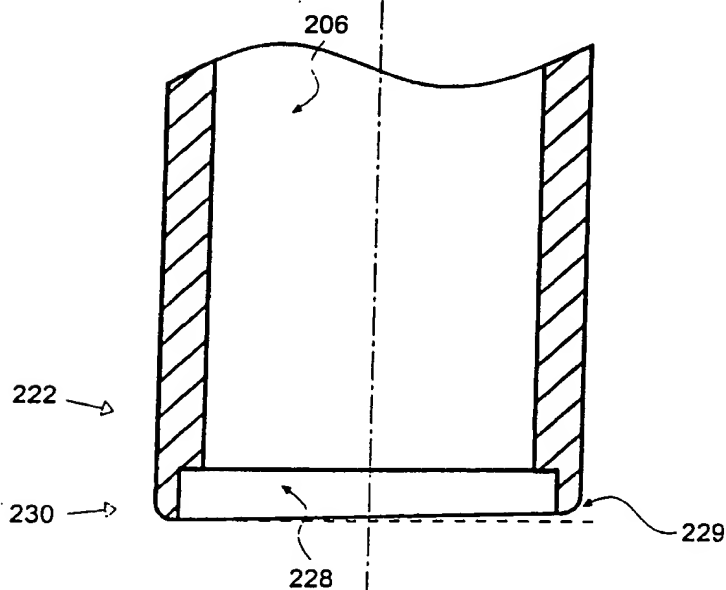


Fig. 11 B



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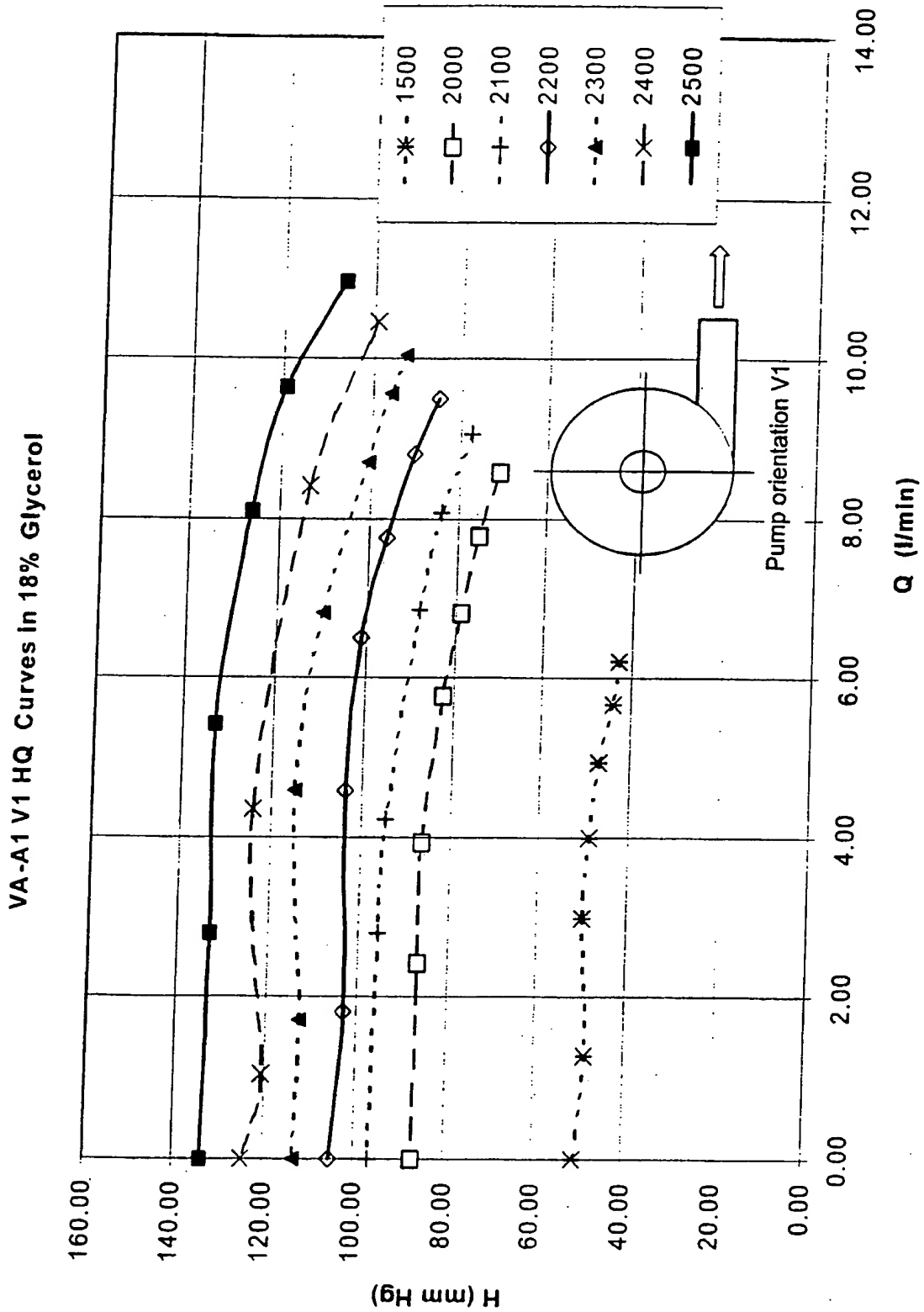


Fig. 13





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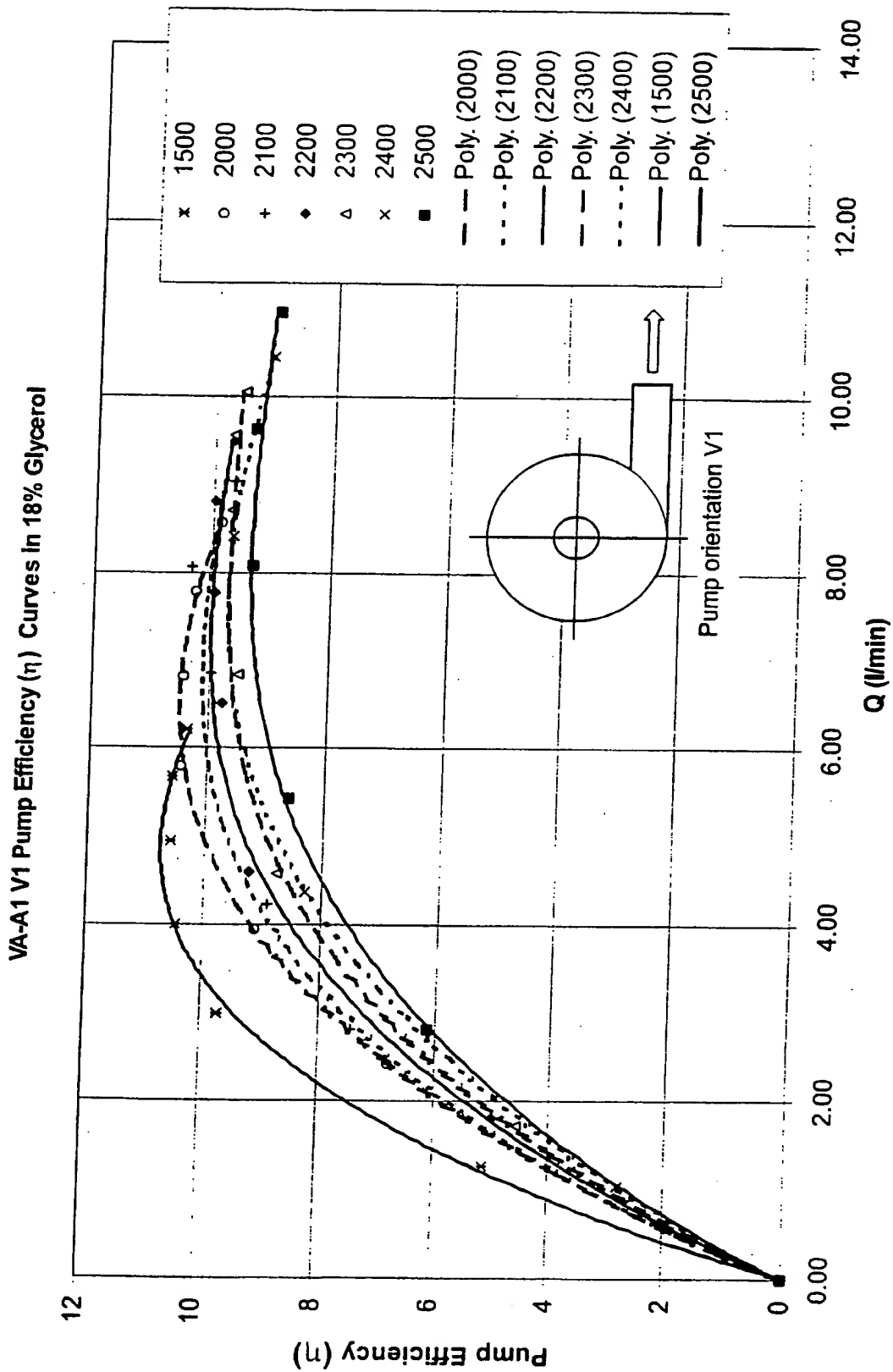


Fig. 14



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VA-A1 V1 Electrical Power vs Flow Rate Curves in 18% Glycerol

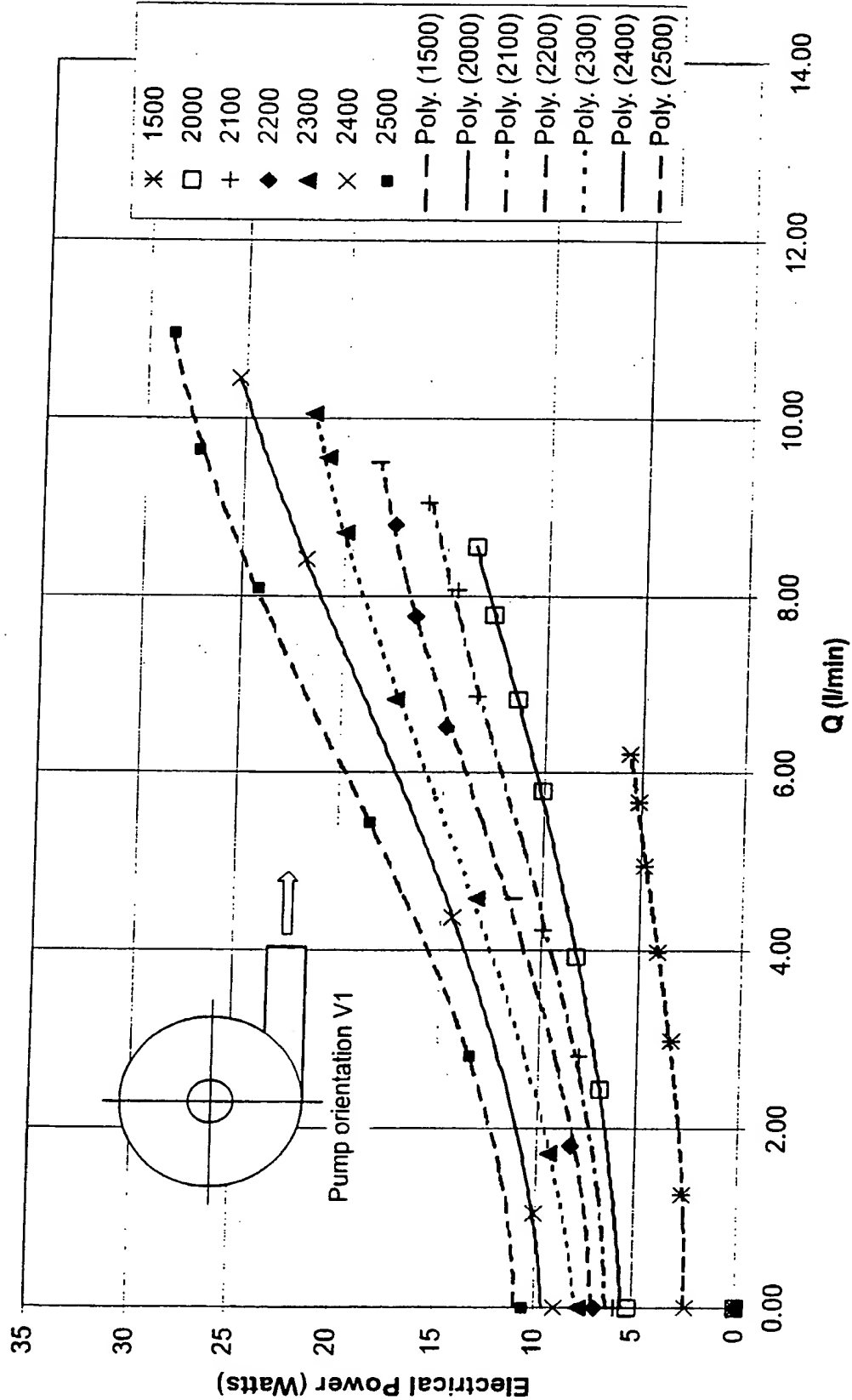


Fig. 15



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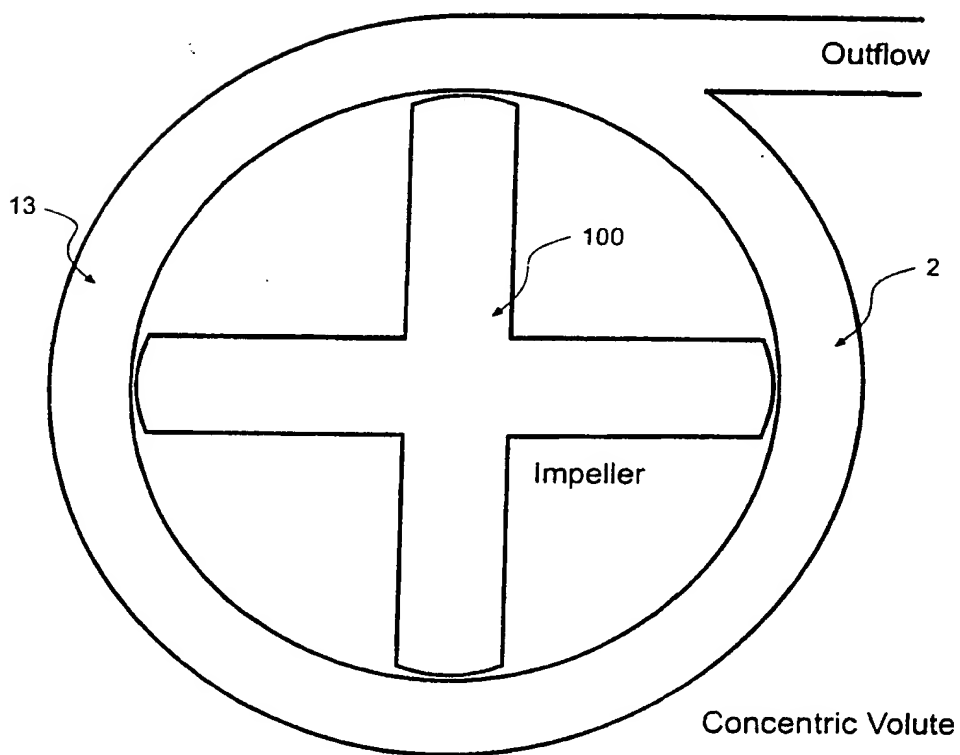


Fig. 16



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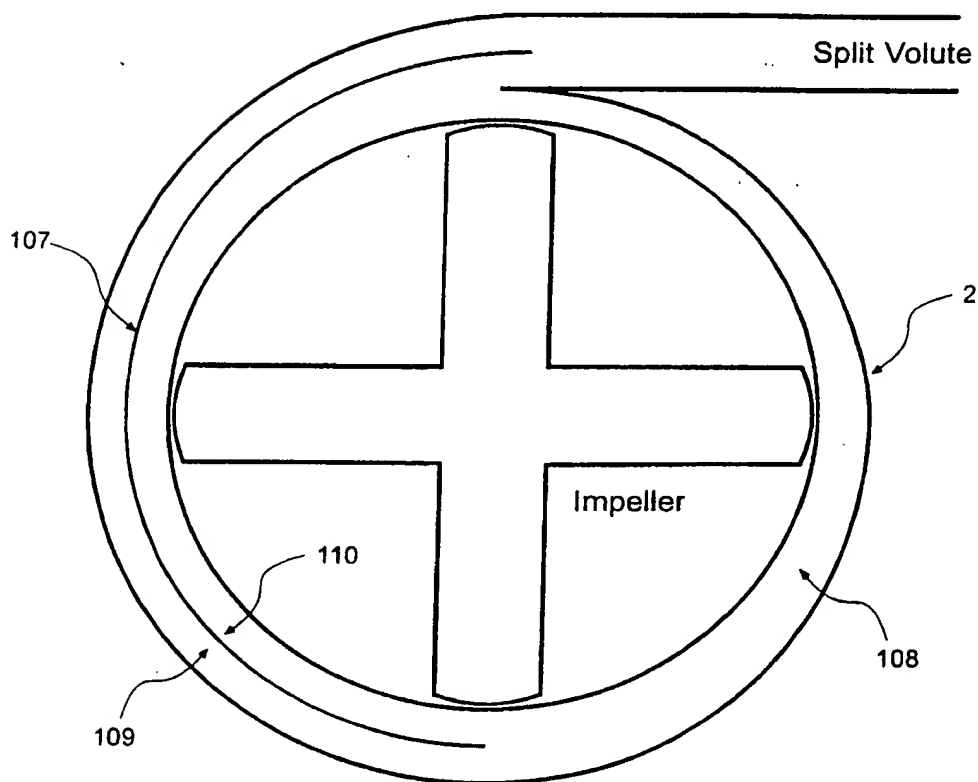


Fig. 17

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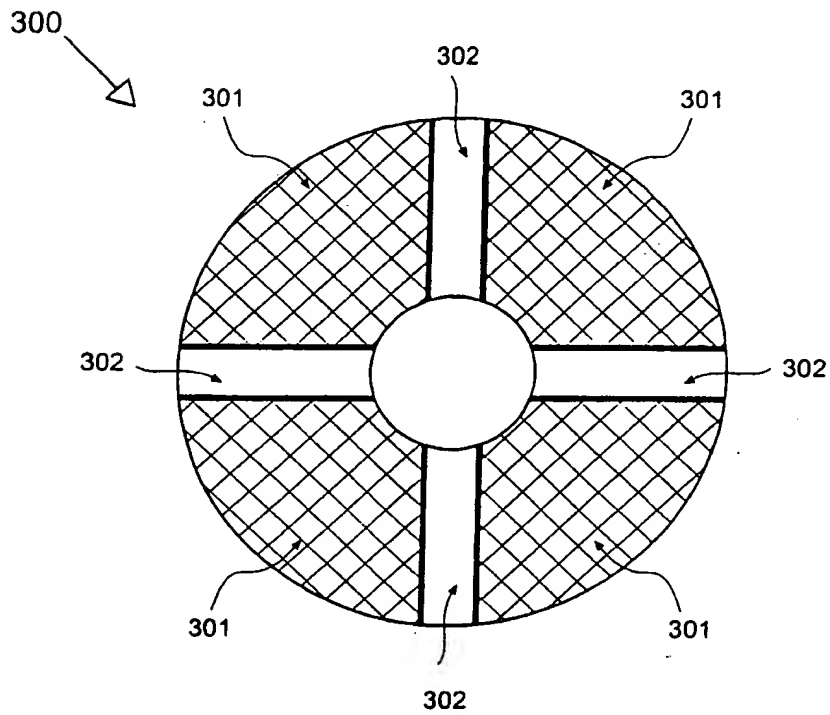


Fig. 18

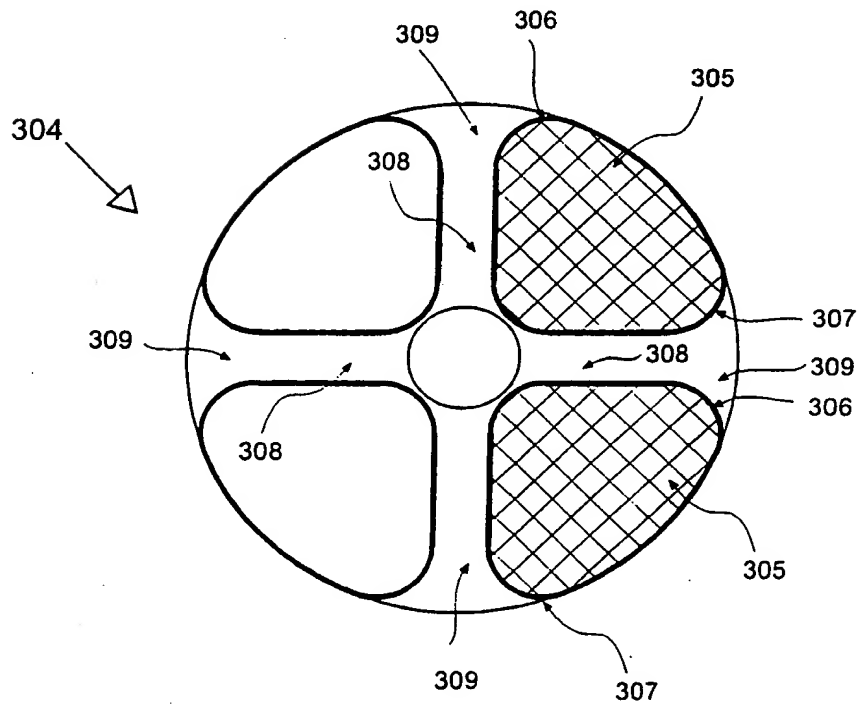


Fig. 19



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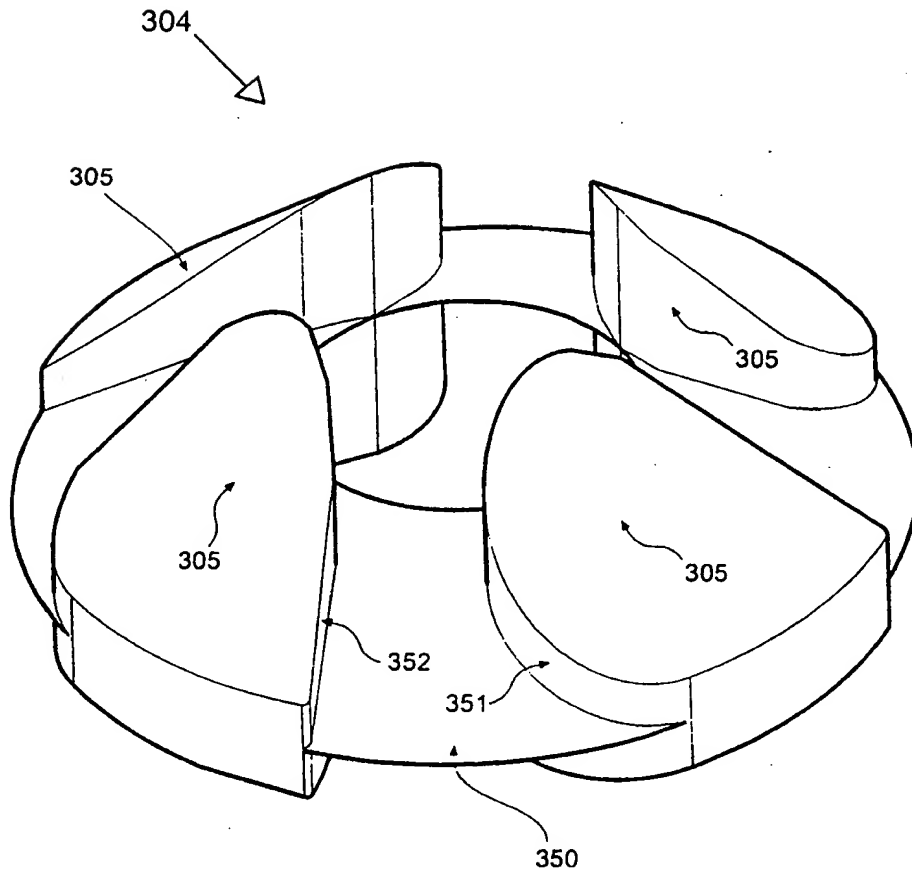


Fig. 20



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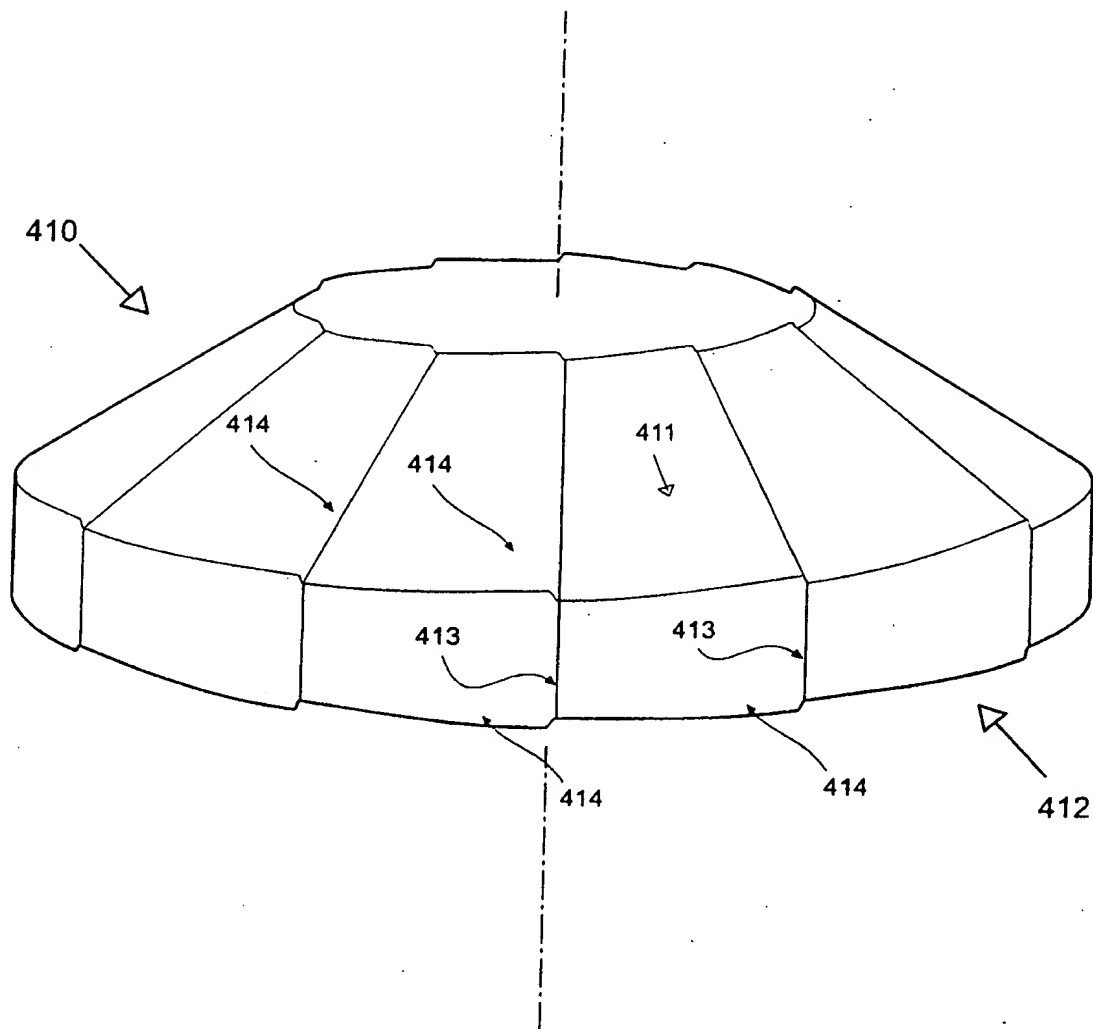


Fig. 21



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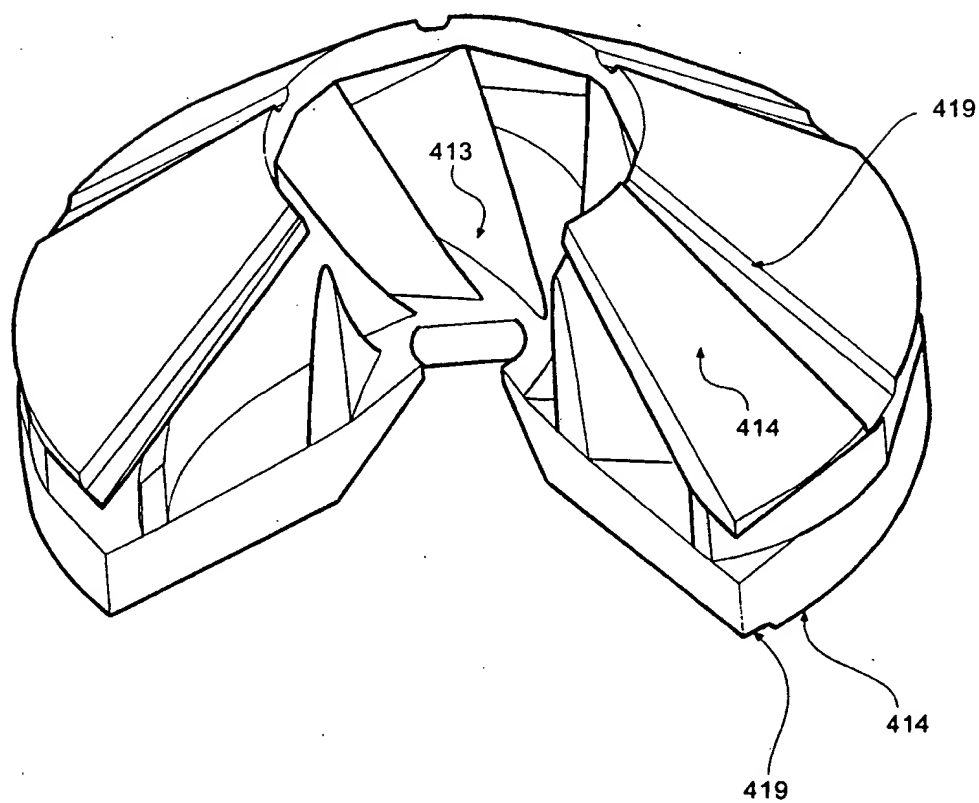


Fig. 22





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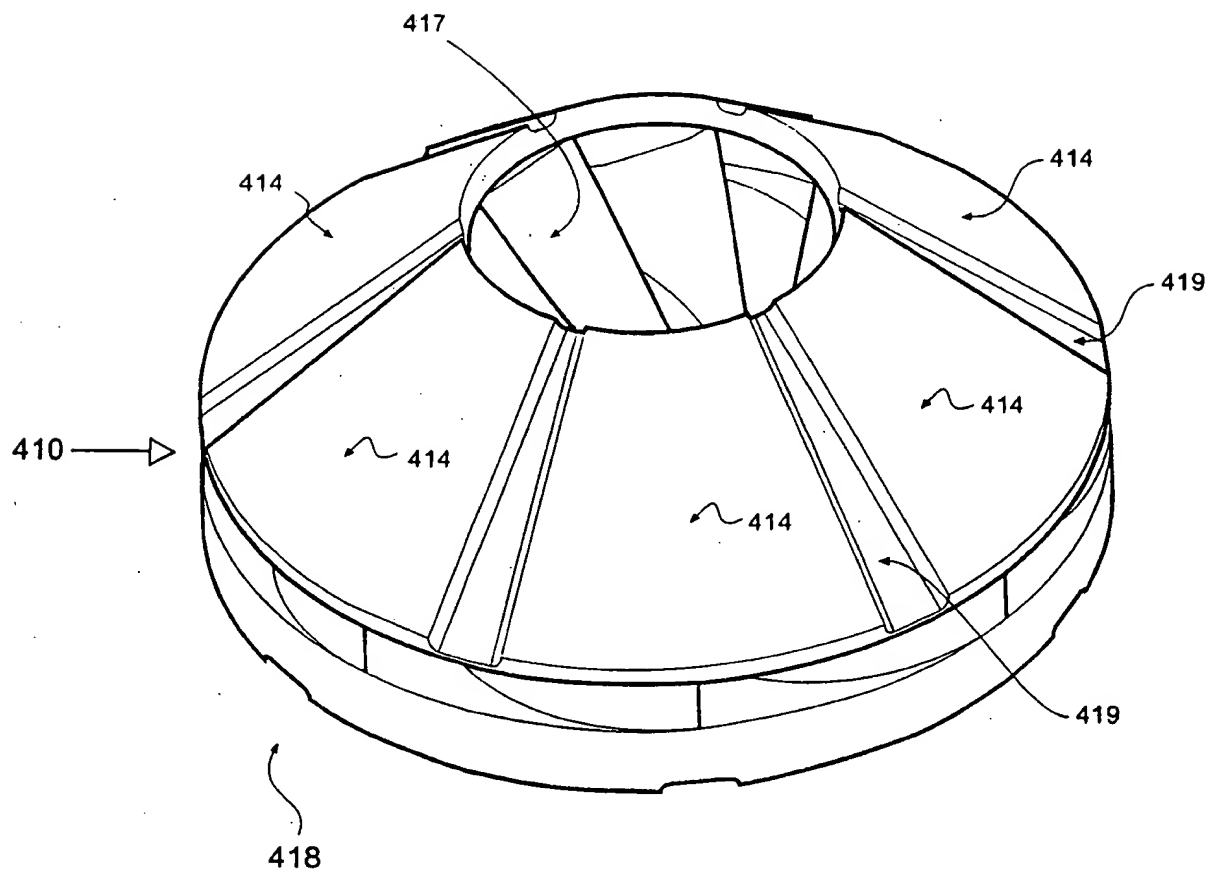


Fig. 23



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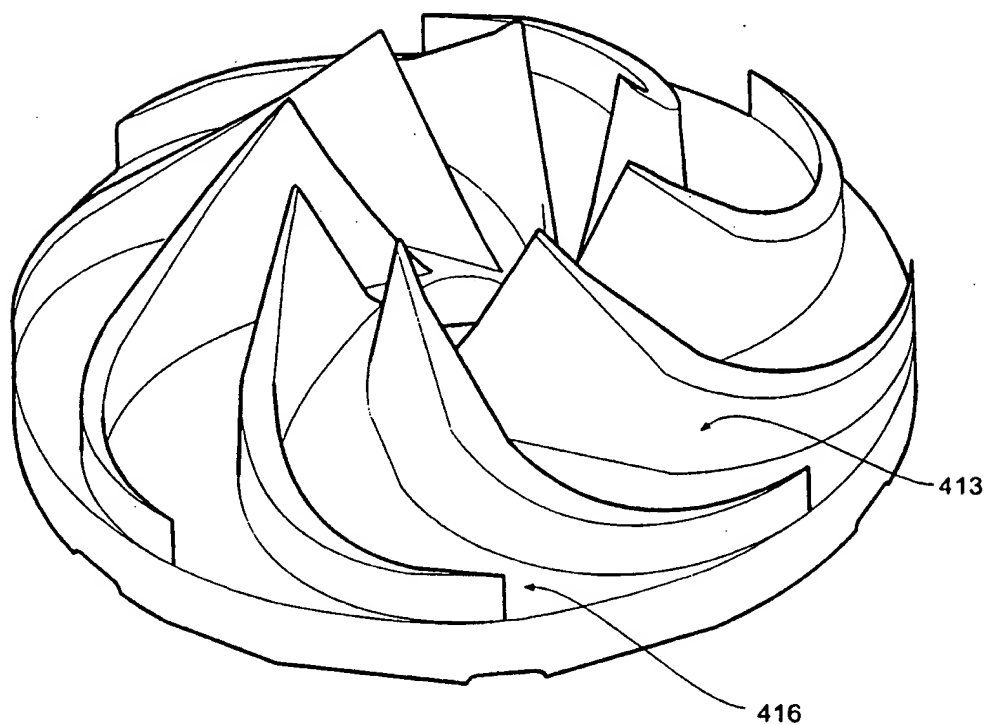


Fig. 24



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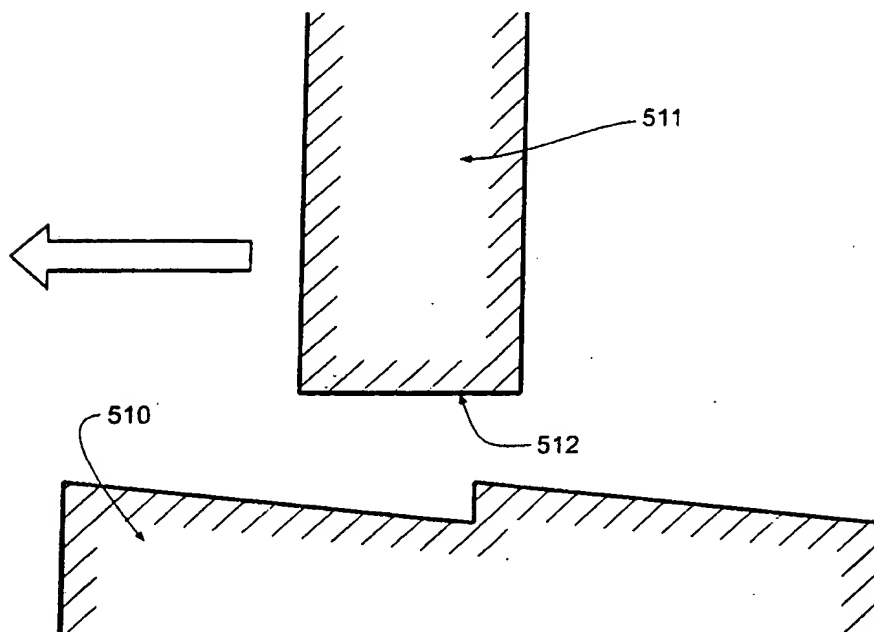


Fig. 25

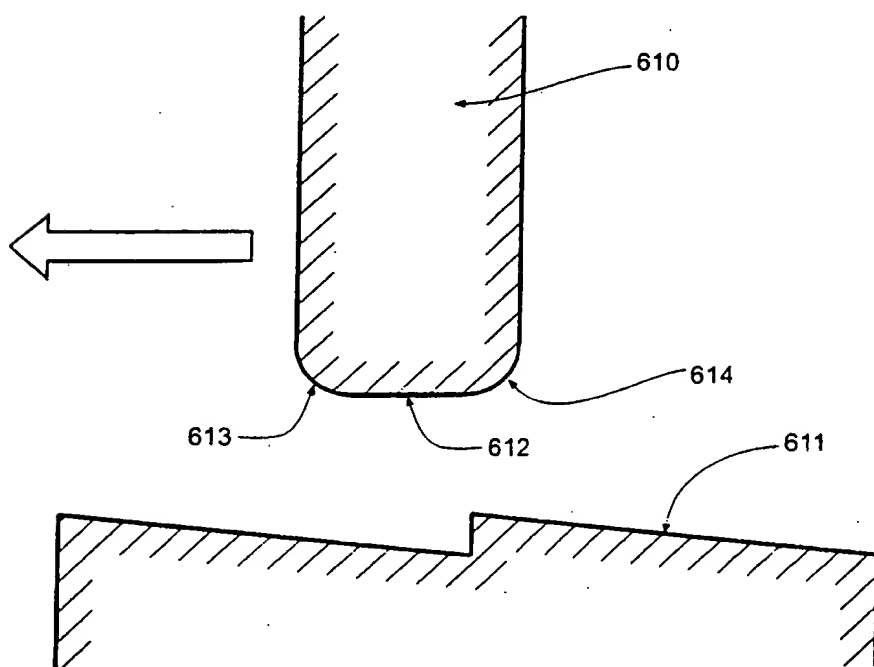


Fig. 26



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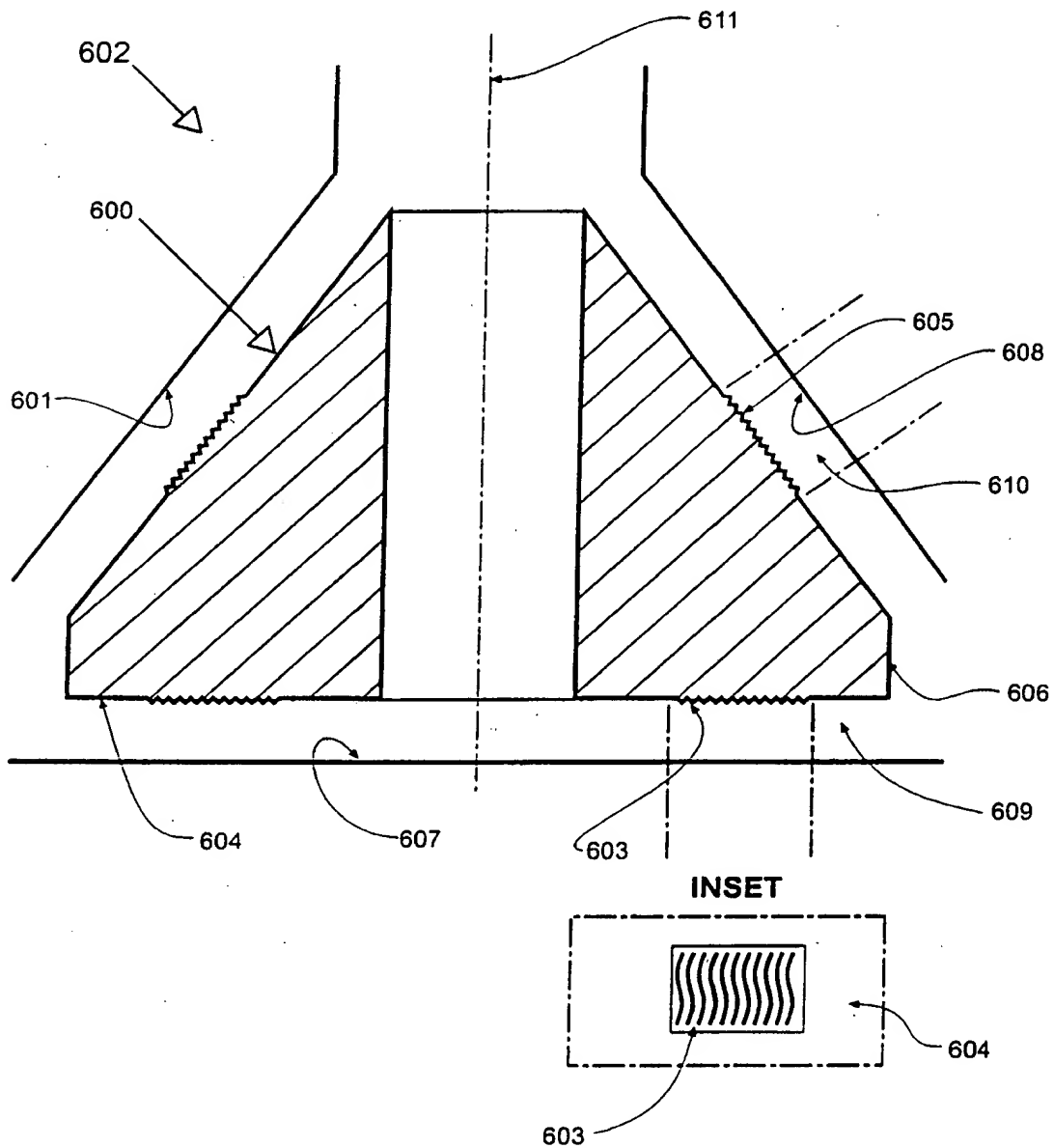


Fig. 27



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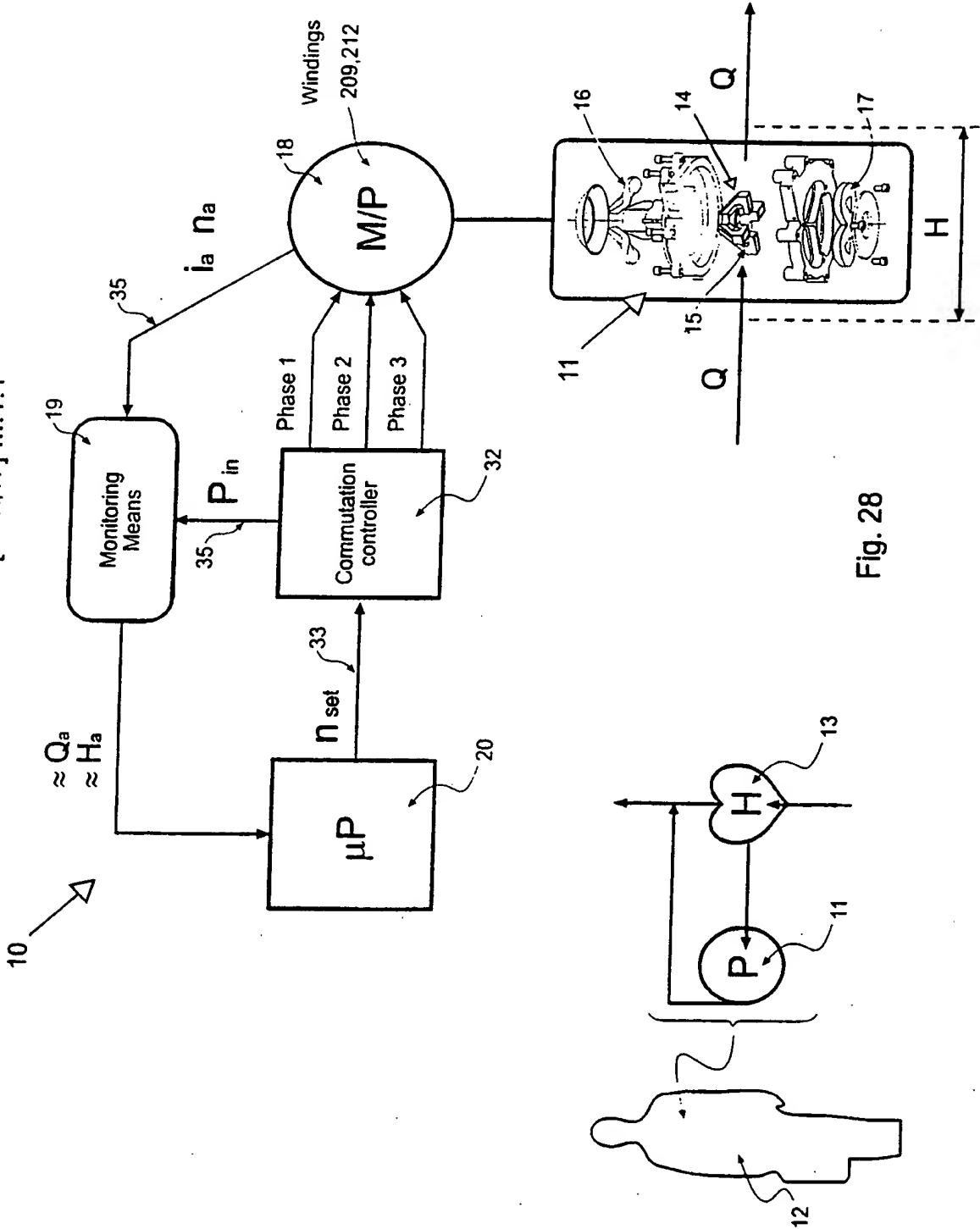
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$$H \triangleq f[P_{in}, N]$$

$$Q \triangleq f[P_{in}, N] \dots 1.1$$





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Flow prediction VA.AB 1.2 Acrylic Unit 2, 6% saline + blood (Hct 32.5%)

$$Q = 20.287603 + 4.731983 \ln(P_{in}) - 0.54863188 \sqrt{n}$$

Q = Flow (l/min)

P<sub>in</sub> = Power In (Watts)

n = Motor speed (rpm)

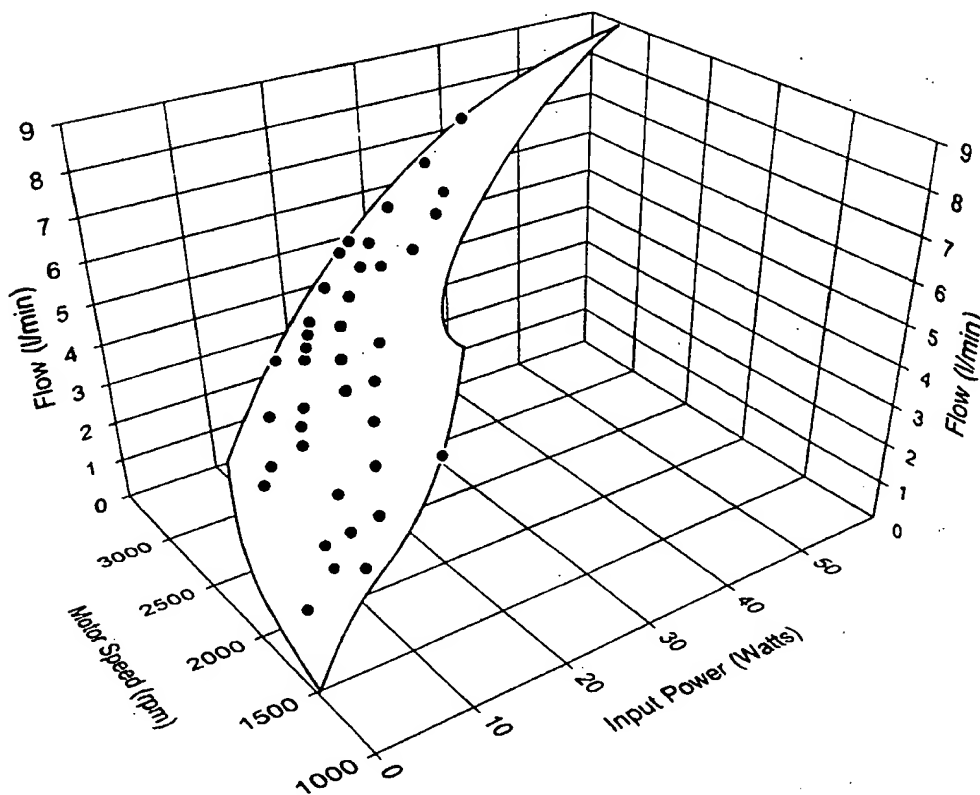


Fig. 29



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

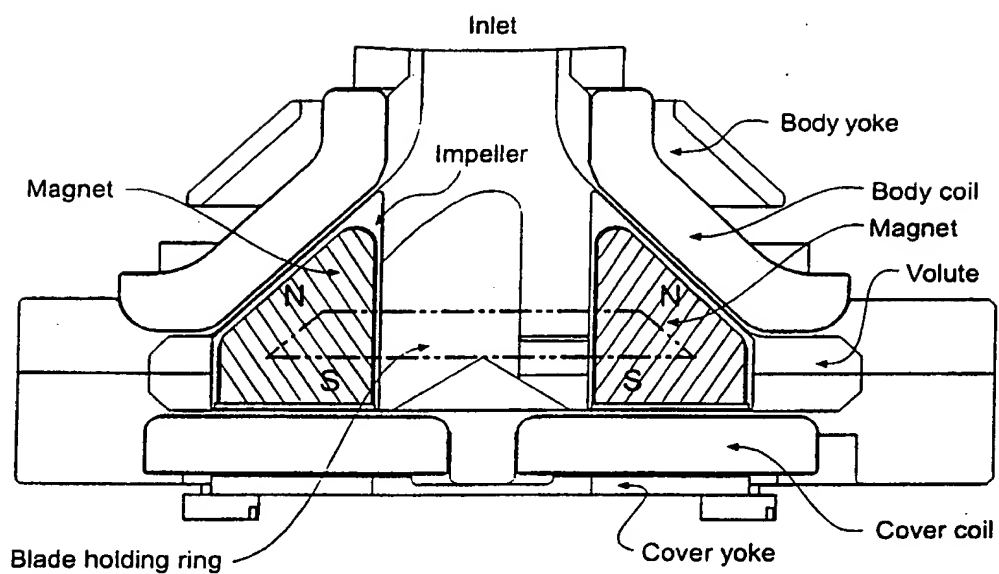
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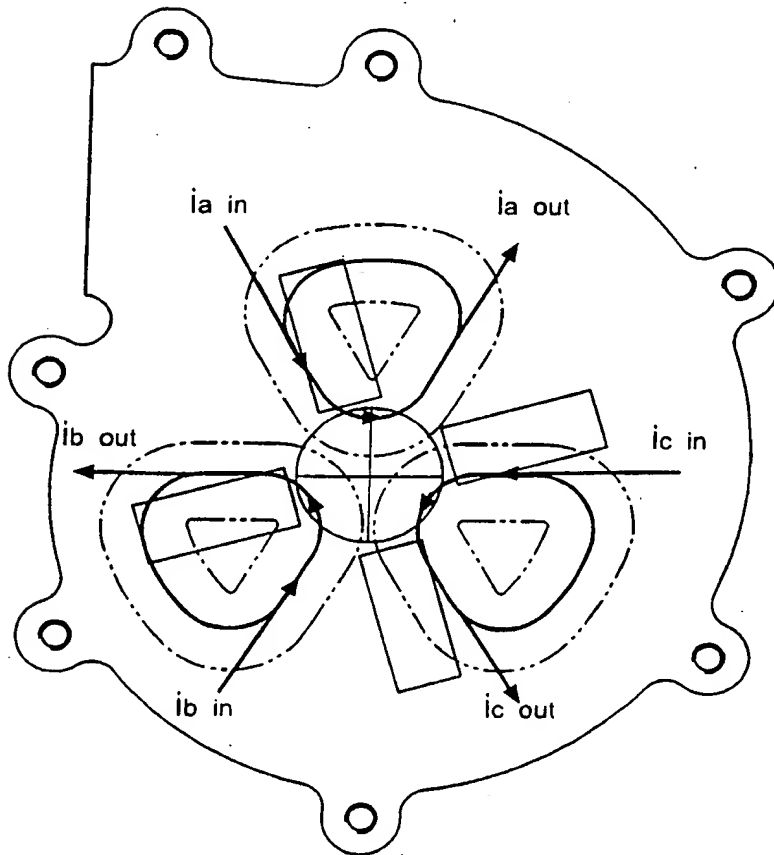


Sketch of the pump cross-section.

Fig. 30

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Cover coil superimposed by rectangular magnets.

Fig. 31



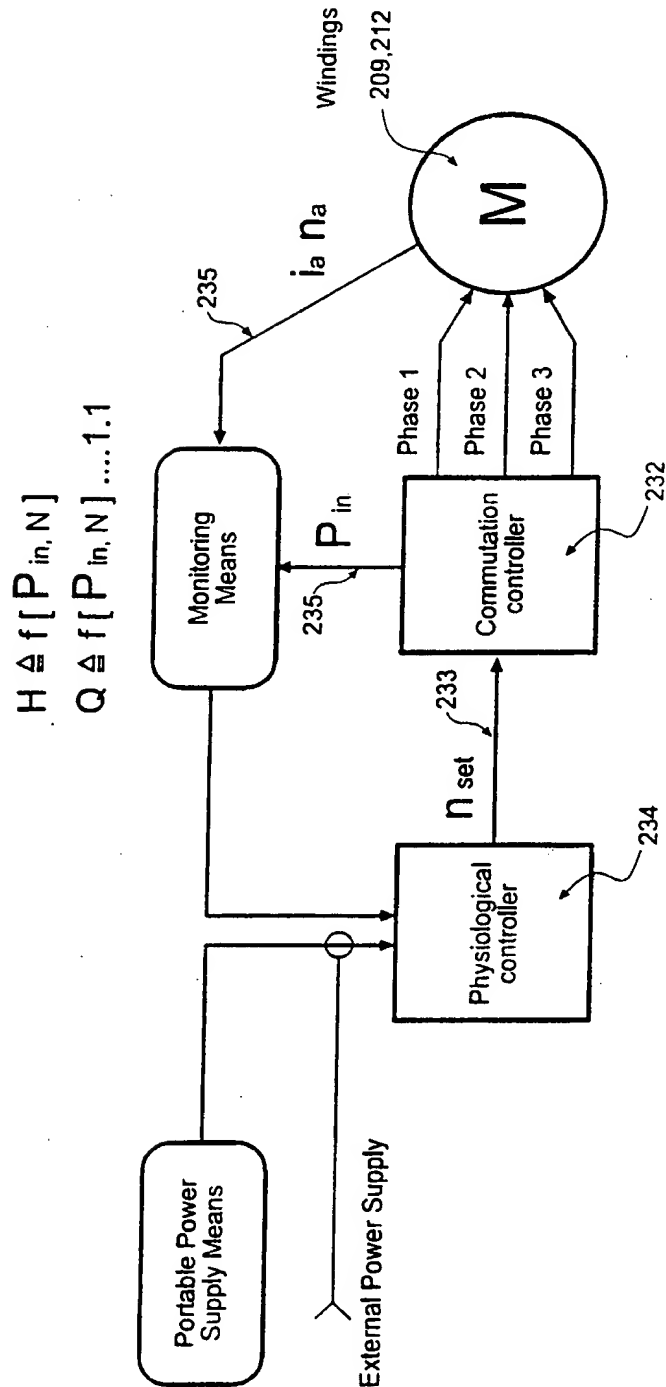


Fig. 32



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## CENTRIFUGAL AND AXIAL FLOW PUMPS

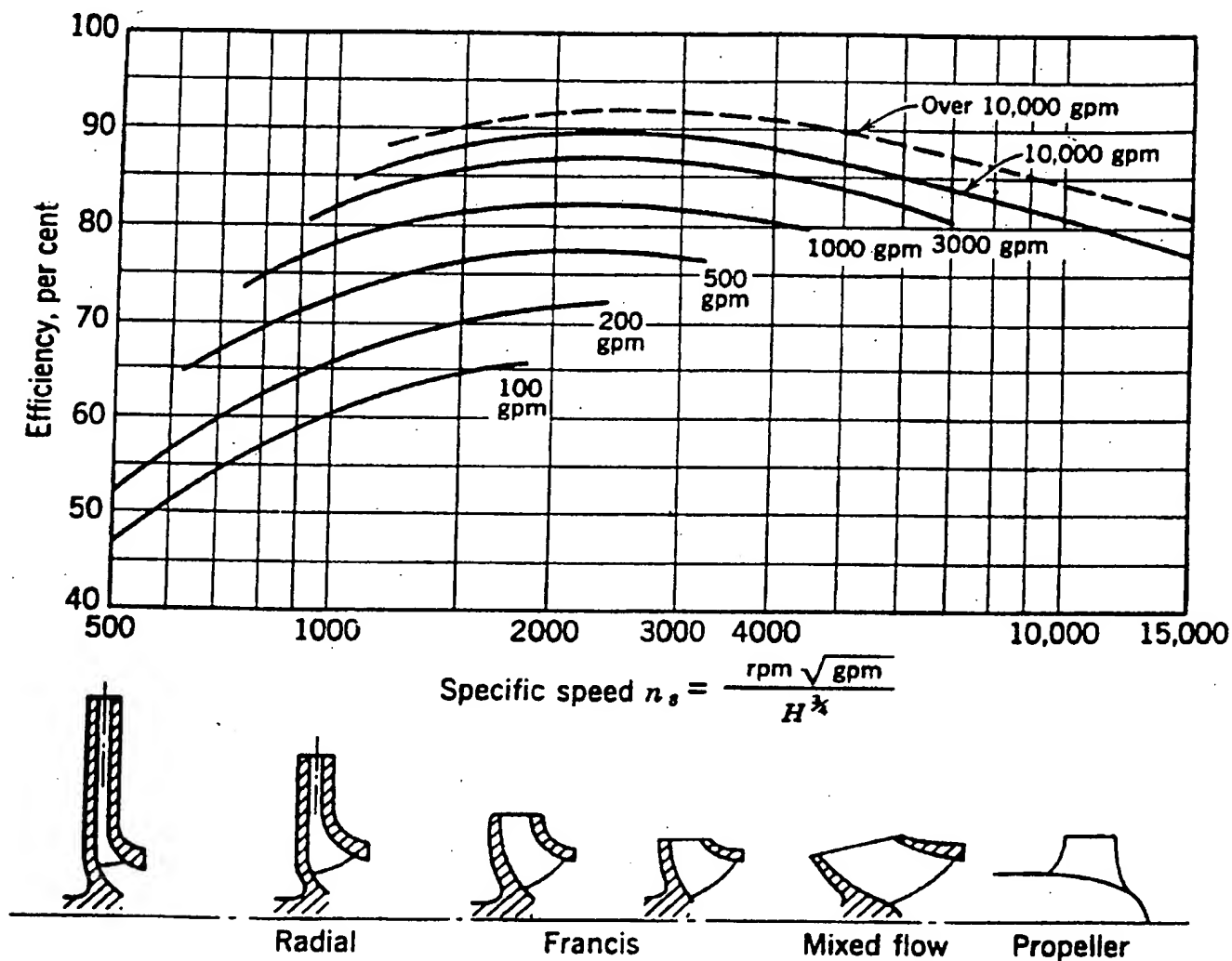


FIG. 5.1. Pump efficiency versus specific speed and pump size (Worthington).

Source: From Stepanoff, A.J. 1993. "Centrifugal and Axial Flow Pumps" (2nd Edition), Krieger Publishing Co. FL. USA.



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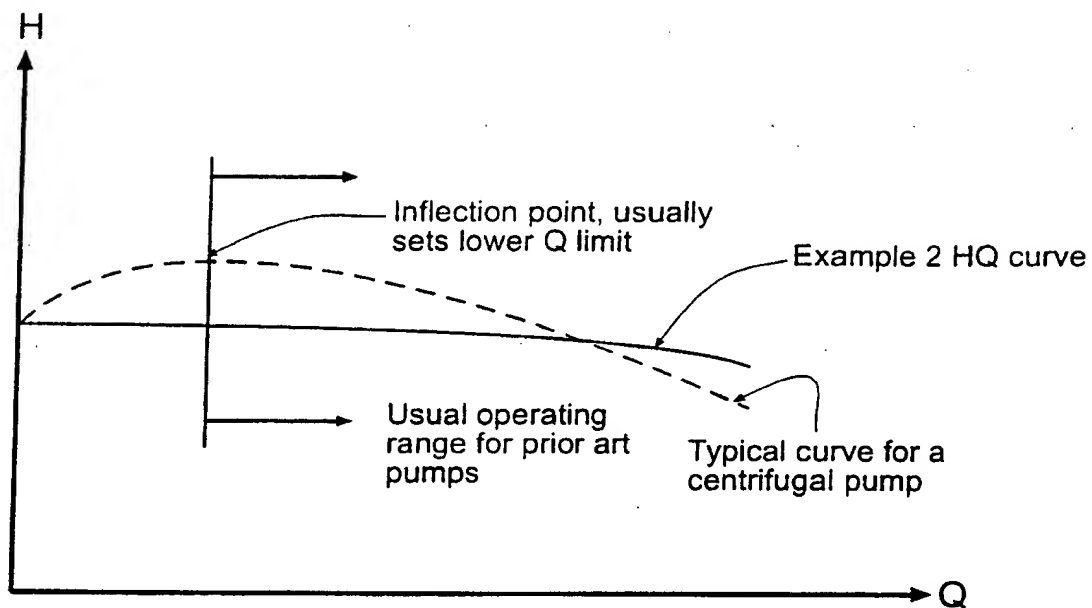
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HQ curves for the pump and a typical centrifugal pump which exhibits a peak in the HQ curve.

Fig. 34



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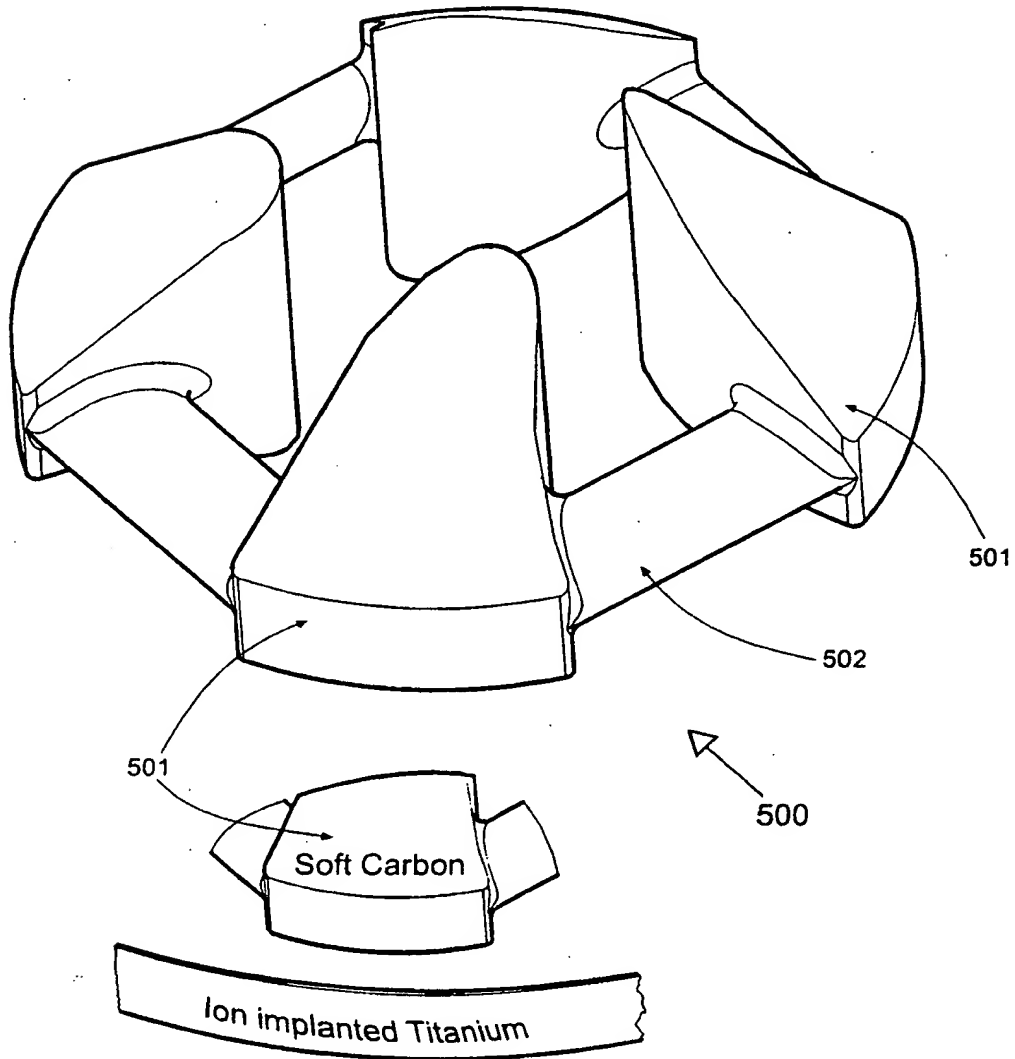


Fig. 35



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

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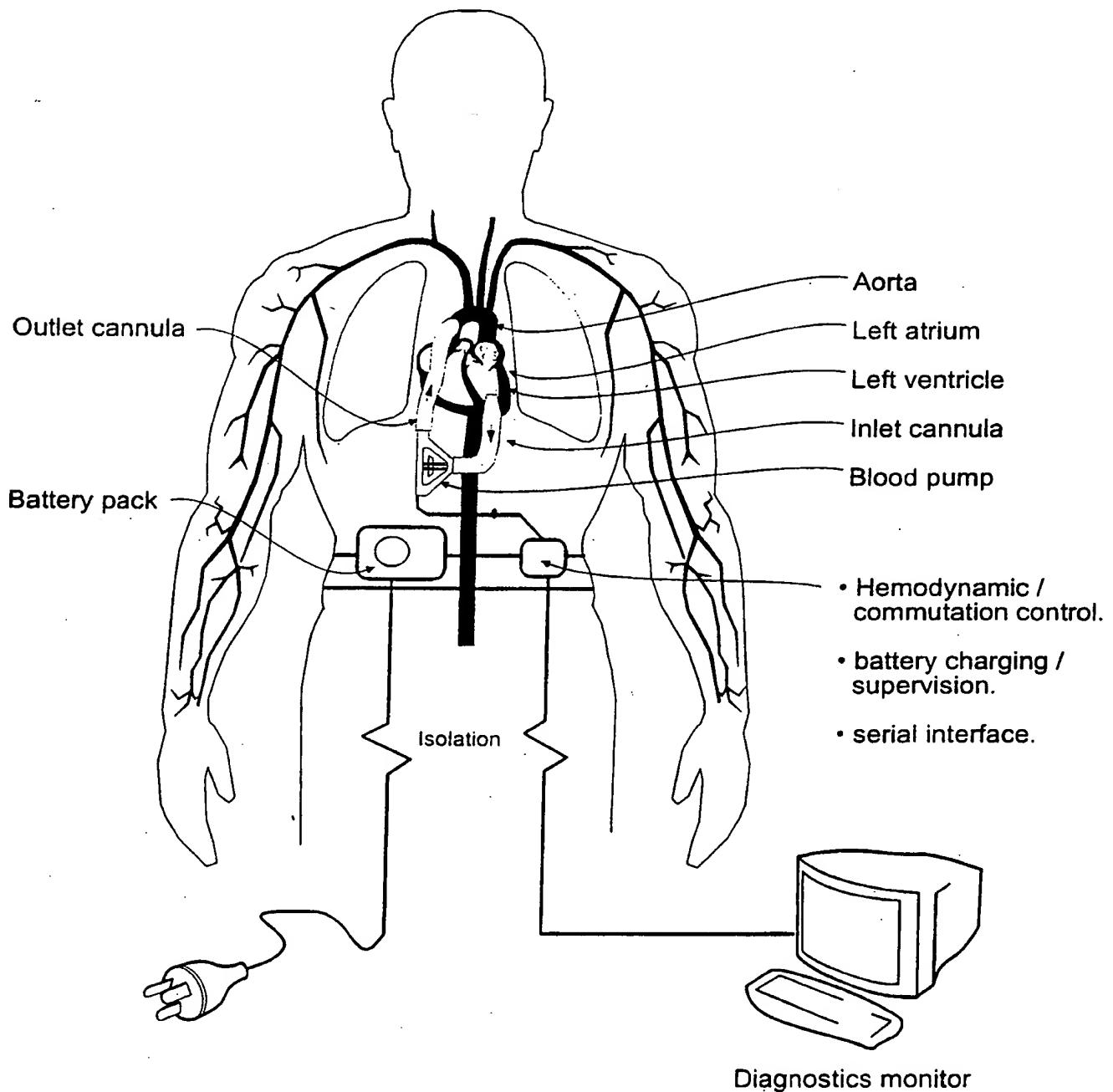


Fig. 36



ROTARY BLOOD PUMP AND CONTROL SYSTEM THEREFOR

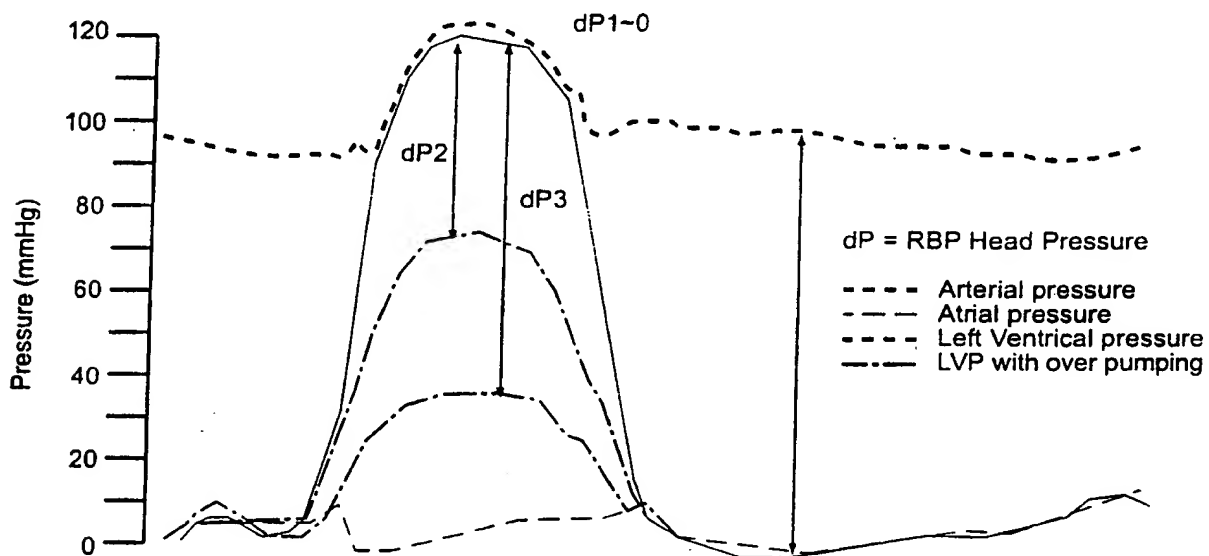
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Normal cardiac cycle and decreasing LVP with over pumping.

Fig. 37



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Pressure Head Estimate for CB #2 RBP 2.8 #6 impeller in 42% HCT

$$z = a + bx + cx^2 + dy + ey^2$$

$$r^2 = 0.99280491$$

$$a = 77.92812$$

$$b = -0.0818024$$

$$c = 4.0719548e-05$$

$$d = 1.8190222$$

$$e = 0.05091337$$

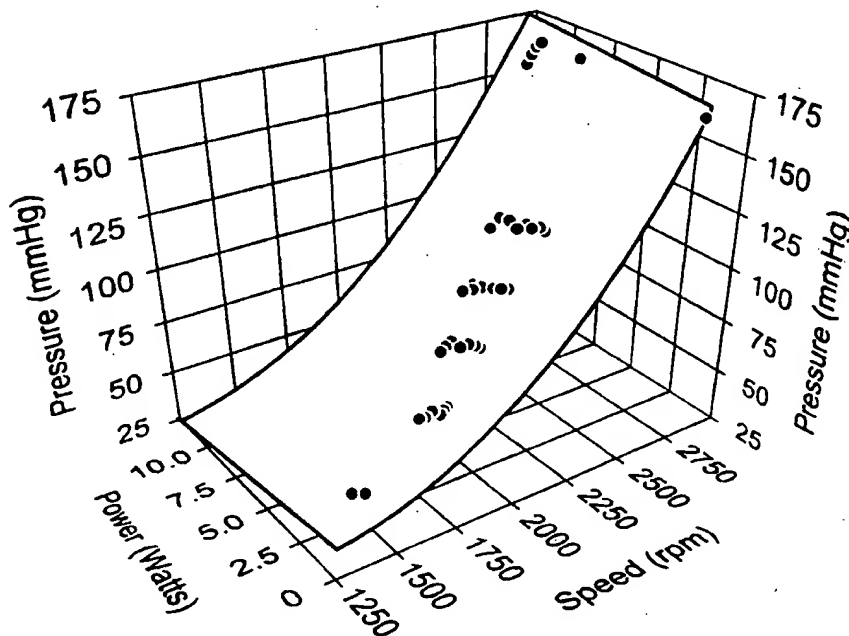


Fig. 38



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Pressure Head Estimate for CB#2 RBP 2.8#6 impeller in 42% HCT

$$z = a + bx + cx^{1.5} + dx^2 + ey + fy^{0.5} \ln y + gy^{0.5}$$

$$r^2 = 0.99107652$$

$$a = 31.539398$$

$$b = -0.27608721$$

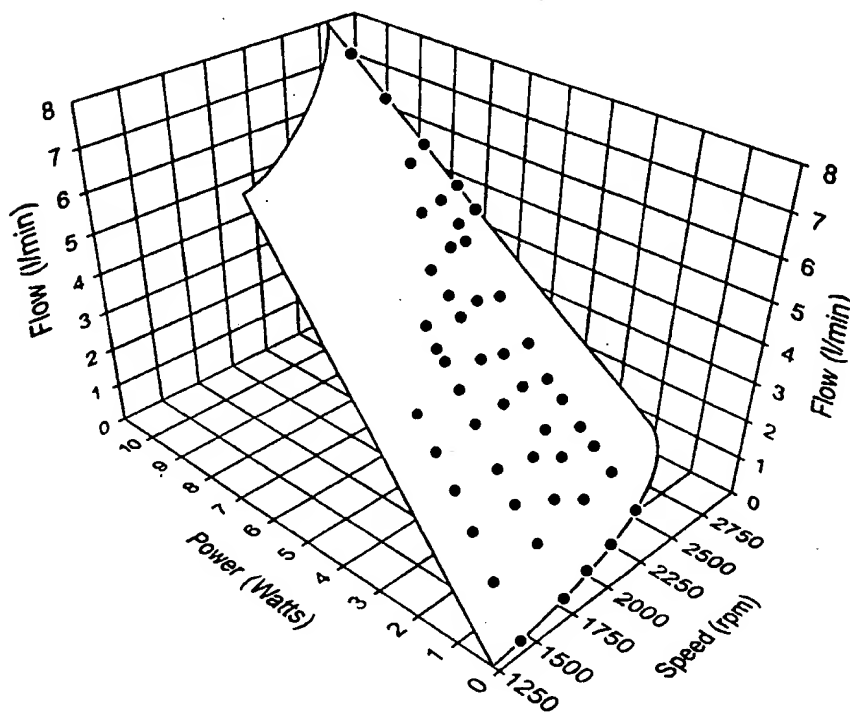
$$c = 0.0077887314$$

$$d = 6.4212762e-05$$

$$e = 9.8953353$$

$$f = 25.194915$$

$$g = 56.85923$$



RBP Flow rate estimate as a function of motor speed and input power.

Fig. 39